

RNA Editing for Muscular Dystrophy Therapy

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Abstract

© 2016, Springer Science+Business Media New York. Due to lack of effective therapies, muscular dystrophies became a focus for gene therapy. Multiple pre-clinical studies have shown successful restoration of dystrophin and dysferlin by RNA editing both in vivo and in vitro, but possibility of a clinical translation is still obscure. A number of new chemicals are being studied, and a search for new techniques is ongoing. This work is intended to give a brief overview of the current state of the RNA editing for treating muscular dystrophies.

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Keywords

Duchenne muscular dystrophy, Dysferlinopathy, Exon skipping, RNA editing, Trans-splicing

References

- [1] Yakovlev, I. A., Deev, R. V., Solovyeva, V. V., Rizvanov, A. A., Isaev, A. A. (2016). Pre- and posttranscriptional genetic information modification in muscular dystrophy treatment. *Genes and Cells*, 2, 42-51.
- [2] Emery, A. E. (2002). The muscular dystrophies. *Lancet*, 359(9307), 687-95.
- [3] Deev, R. V., Mavlikeev, M. O., Bozo, I. Y., Pulin, A. A., Eremin, I. I. (2014). Gene- and cell-based therapy of muscle system hereditary disorders: state-of-art. *Genes and Cells*, 4, 9-33.
- [4] Aoki, M. (2004). Dysferlinopathy (Updated 2015 Mar 5). In R. A. Pagon, M. P. Adam, H. H. Ardinger, et al. (Eds.), *GeneReviews* (Internet) (pp. 1993-2016). Seattle: University of Washington.
- [5] DMD Gene (Protein Coding) <http://www.genecards.org/cgi-bin/carddisp.pl?gene=DMD>
- [6] Siva, K., Covello, G., Denti, M. A. (2014). Exon-skipping antisense oligonucleotides to correct missplicing in neurogenetic diseases nucleic acid therapeutics. *Nucleic Acid Therapeutics*, 24(1), 70.
- [7] Dhir, A., & Buratti, E. (2010). Alternative splicing: role of pseudoexons in human disease and potential therapeutic strategies. *FEBS Journal*, 277(4), 841-55.
- [8] Aartsma-Rus, A., Fokkema, I., Verschuuren, J., et al. (2009). Theoretic applicability of antisense-mediated exon skipping for Duchenne muscular dystrophy mutations. *Human Mutation*, 30, 293-299.
- [9] Beroud, C., Tuffery-Giraud, S., Matsuo, M., et al. (2007). Multiexon skipping leading to an artificial DMD protein lacking amino acids from exons 45 through 55 could rescue up to 63% of patients with Duchenne muscular dystrophy. *Human Mutation*, 28, 196-202.
- [10] Shimizu-Motohashi, Y., Miyatake, S., Komaki, H., Takeda, S., Aoki, Y. (2016). Recent advances in innovative therapeutic approaches for Duchenne muscular dystrophy: from discovery to clinical trials. *American Journal of Translational Research*, 8(6), 2471-89.
- [11] BioMarin Announces Withdrawal of Market Authorization Application for Kyndrisa™ (drisapersen) in Europe (2016) <http://investors.bmrn.com/releasedetail.cfm?releaseid=973536>
- [12] U.S. Food and Drug Administration (2016). FDA grants accelerated approval to first drug for Duchenne muscular dystrophy <http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm521263.htm>. Accessed 30 October 2016

- [13] Goyenvalle, A., Griffith, G., Babbs, A., et al. (2015). Functional correction in mouse models of muscular dystrophy using exon-skipping tricyclo-DNA oligomers. *Nature Medicine*, 21(3), 270–5.
- [14] Wilton, S. D., Veedu, R. N., Fletcher, S. (2015). The emperor's new dystrophin: finding sense in the noise. *Trends in Molecular Medicine*, 21, 417–426.
- [15] Peccate C, Mollard A, Le Hir M. (2016). Antisense pre-treatment increases gene therapy efficacy in dystrophic muscles. *Human Molecular Genetics* (Epub ahead of print)
- [16] Wein, N., Avril, A., Bartoli, M., et al. (2010). Efficient bypass of mutations in dysferlin deficient patient cells by anti-sense-induced exon skipping. *Human Mutation*, 31, 136–42.
- [17] Lee, J., Echigoya, Y., Duddy, W., Yokota, T. (2016). Optimizing antisense oligonucleotide design for achieving exon skipping in dysferlinopathy cell lines. *Myology*, 2016, 138.
- [18] Monjaret, F., Bourg, N., Suel, L. (2014). Cis-splicing and translation of the pre-trans-splicing molecule combine with efficiency in spliceosome-mediated RNA trans-splicing. *Molecular Therapy*, 22(6), 1176–87.
- [19] Philippi, S., Lorain, S., Beley, C. (2015). Dysferlin rescue by spliceosome-mediated pre-mRNA trans-splicing targeting introns harbouring weakly defined 3' splice sites. *Human Molecular Genetics*, 24(14), 4049–60.